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Study on Effects and Occurrence of Nematodes in Local and Exotic Chickens in and Around Bahir Dar, Northwest Ethiopia

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Abstract: A cross sectional study was conducted from November 2013 to April 2014 to investigate gastrointestinal (GI) nematode parasites in chickens in and around Bahir Dar, northwest Ethiopia. A total of 384 chickens comprising of 112 exotic and 272 local were examined for gastrointestinal nematode infections. Out of these, 180 (46.9%) were found to be infected with GI nematode parasites. The nematode species found in chickens were *Ascaridia galii* (15.1%), *Heterakis gallinarum* (11.7%), *Capillaria columbae* (4.4%) and *Subulura brumpti* (2.9%). There was a statistically significant difference ($p<0.05$) in the prevalence between breeds of chickens in which higher infection rate was observed in local breed chickens (51.47%) than exotic breeds (33.6%). There was also a statistically significant difference ($p<0.05$) among age groups where higher prevalence of GI nematodes was recorded in adults (50.55%) compared to growers (38.93%). In addition, there was a statistically significant association ($p<0.05$) in prevalence between the different management systems where there was higher infection rate was recorded in extensive management system (51.47) compared to intensive management system. There was no a statistically significant difference ($p>0.05$) among sex category of chickens in which the prevalence of infection was 49.29 and 44.4% in female and male chickens. Mixed infections with two or more parasite species were also observed (12.8%). This study strongly suggested that GI nematode parasites are a very serious problem of backyard chickens in the study area and appropriate control strategies need to be devised.

Key words: Gastrointestinal Nematode · Chicken · Bahir Dar

INTRODUCTION

Poultry are kept in backyards or commercial production systems in most areas of the world. Compared to a number of other livestock species, fewer social and religious taboos are related to the production, marketing and consumption of poultry products. For these reasons poultry products have become one of the most important protein sources for man throughout the world [1]. In developing countries poultry production offers an opportunity to feed the fast growing human population and too provide income resource for poor farmers. Moreover, Poultry in many parts of the modern world is considered as the chief source of not only cheaper protein of animal origin but also of high quality human food [2]. In Ethiopia the word "poultry production" is synonymous with chicken production under the present Ethiopian conditions and thus, the word poultry synonymous to chicken too while others are found in their natural habitat (wild) [3].

Poultry among the important species of livestock kept in Ethiopia, their production system is identified in the country. These are backyard poultry production system, small scale and large scale intensive production systems [4]. The population of poultry in Ethiopia is estimated to be 44.89million excluding the pastoral and agro-pastoral areas. With regard to breed, 96.46 %, 0.57 percent and 2.97 percent of the total poultry were reported to be indigenous, hybrid and exotic, respectively [5]. Despite the presence of large number of chicken in Ethiopia, contribution to the national economy or benefit exploited is very limited due to nutritional limitation and diseases [6].

Among parasitic diseases of poultry nematode parasite is one of the major problems of chicken industry in the world which is characterized by riffled feather,

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loss of appetite, poor growth and reduced egg production [7]. More over nematodes (roundworms) are the most important group of helminthes parasites of poultry. This is due to the large number of parasitic species that cause damage to the host, especially in severe infections. Most roundworms affect the gastrointestinal tract, with an occasional parasite affecting the trachea or eye. Each species of roundworm tends to infect a specific area of the intestinal gastro tract. Different species of the same genus may infect several different areas of the tract. In general, the different species of roundworms have very similar life cycles [8].

Of the helminth parasites of poultry birds, nematodes constitute the most important group of helminth parasites of poultry both in number of species and the extent of damage they cause; the main genera include *Ascaridia, Heterakis* and *Capillaria* [9].

Generally, nematodes of poultry infection are widely distributed in different parts of the world. and numerous research has been existed to prevent the mortality of poultry from parasitic diseases,and the prevalence of two nematodes species, *Heterakis gallinarum* and *Subulura suctoria* from the ceacal of Guinea fowl (Numedia meleagries) [10]. After a while three nematodes species from white leghorn chicken namely; *Ascaridia galli*, *Heterakis gallinarum* and *Subulura brumpti* were observed [11]. So, keeping in view the importance of these parasites in chickens, the present study was designed to investigate the prevalence and identify the different species of GI nematode parasites infecting chickens and to provide guide line in adopting the preventive measures to treat and control the parasitic infection.

However, there was a scarcity of information regarding the prevalence of GI nematode parasites of chickens in the study area. Therefore, the objectives of this study were to estimate the prevalence of major gastrointestinal nematode parasites in poultry and assess the risk factors associated with the incidence of the parasites in the study area. To identify the different species of GI nematodes infecting chickens and to provide guide line in adopting the preventive measures to treat and control the parasitic infection.

MATERIALS AND METHODS

Study Area: The Study was conducted from November 2013 to April 2014 in and around Bahir-Dar which is located, in the northwestern part of Ethiopia. The study area is located at 11°29' -11°41' N latitude and 37°16'- 37°27'E longitude. The average elevation of the study area is about 1795 m.a.s.l. The study area experiences average annual rainfall that ranges from 1200-1600 mm and it has mean annual temperature of 26°C [12].

Study Populations: Study population includes 384 chickens (272 local, 112 exotic) managed under backyard and commercial systems. The age of the study animals was determined by asking the owners.

Study Design and Sample Size Determination: Simple random sampling method was implemented for sampling of chicken. Sample size for the study was calculated using the formula given by Thrusfield [13] with precision level of 5%, confidence interval of 95% and the expected prevalence of 50% since there was no similar study done previously on the study area. Accordingly, the required sample size was 384.

Sample Collection and Examination: Three hundred eighty-four faecal samples comprising of 272 local and 112 exotic breeds of chickens were collected per cloaca. All samples were put in clean sample bottles containing 10% formalin as preservative and identified appropriately. The samples were later processed in the laboratory using the salt floatation technique.[14]. Identification of nematode eggs was done using a standard microscope under ×10 objective magnification.

Data Management and Analysis: The information obtained from laboratory test and observation was entered on the spreadsheet of Microsoft excel work sheet. Descriptive statistics and Chi-square (χ^2) test was used to analyze the sample data. Overall prevalence was calculated by dividing the number of positive animals by the total number of animals examined and times 100. Chi-square test was used to asses weather there is a statistical significant difference in gastrointestinal nematode infection between breed, sex, age and management. A statistically significant association between variables was considered to exist if the calculated p-value is less than 0.05 with 95% confidence level.

RESULTS

The result of the faecal analyses showed that of the 384 faecal samples collected and examined, 180 (46.9%) of the samples were collectively positive for GI nematode eggs. The result revealed that *A. galli* and *H.gallinarum* had the highest prevalence rate of infection in both the local and exotic breeds (Table 1).

Table 1: Overall prevalence of gastro-intestinal nematode parasites of chickens from the study area.

Nematode parasite spp	No. of examined	No. of positive	Prevalence (%)
Ascaridia galli	384	58	15.1%
Heterakis gallinarum	384	45	11.7%
Capillaria columbae	384	17	4.4%
Subulura brumpti	384	11	2.9%

Table 2: Prevalence of GI nematodes parasites on the basis of breed, sex, age,

Variable category		No. examined	No. infected (%)	χ^2	P-value
Breed	Local	272	140(51.47)		
	Exotic	11 2	41(33.6)	7.034	0.008
Sex	Male	171	76(44.4)	0.896	0.344
	Female	213	105(49.29)		
Age	Grower	113	44(38.93)	4.318	0.038
	Adult	271	137(50.55)		

Table 3: The prevalence of gastro-intestinal nematodes in relation to different management systems

Management	No of examined	No infected (%)	χ^2	p-value
Extensive	272	140(51.47)	7.03	0.008
Intensive	112	41(36.6)		

Table 4: Overall prevalence of gastro-intestinal nematode parasites of chickens from the study area.

Nematode parasite spp	No. of examined	No. of positive	Prevalence (%)
Ascaridia galli	384	58	15.1%
Heterakis gallinarum	384	45	11.7%
Capillaria columbae	384	17	4.4%
Subulura brumpti	384	11	2.9%

Nematode infection was more prevalent in female (49.3%) than male (44.4%) chickens. However, there was no significance difference (χ^2=0.896 and P>0.05) in the prevalence of gastrointestinal nematode parasites in different sexes. In concerning age groups, higher prevalence (50.6%) was observed in adult chickens compared to grower (38.9%) aged groups. The difference in prevalence between the two age groups was statically significant (χ^2=4.318, p<0.05) (Table 1).

In the present study the association between the prevalence of gastro-intestinal nematode parasites with different management system was also assessed. The prevalence of gastro-intestinal nematode was significantly different (χ^2=7.034, p<0.05) in the two poultry keeping systems where it was higher in the extensive system (51.5%) than the intensive system (36.6%) (Table 2).

The species of GI nematodes recorded from fecal examination were *Ascaridia gallii* (15.1%), *Heterakis gallinarum* (11.7%), *Capillaria collombae* (4.4%) and *Subulura brumpti* (2.9%). The difference in these prevalence rates was statistically significant (P<0.05) (Table 3).

DISCUSSION

In this cross-sectional study the overall prevalence of infection with gastro-intestinal nematodes was 46.9%. This finding was higher than previous reports of Hirut [15] and Nnadi and George [16] with a prevalence of 39.2% and 35.5% from Ethiopia and Nigeria respectively. Nonetheless, this finding was lower than the report of Yehualashet [17] and Matur *et al*. [9] who reported a prevalence of 59.64% and 53% in Ethiopia and Nigeria. This discrepancy could be related to the differences in the management system, study method, sample size and control practices in the area.

The most prevalent nematode species encountered in the present study was *Ascaridia galli* (15.1%) followed by *Heterakis galinarum* (11.7%), *Capillaria collombae* (4.4) and *Subulura brumpti* (2.9%). However, the prevalence of *Ascaridia galli* was much lower than the previous reported works in central Ethiopia by Ashenafi and Eshetu [18] (55.26%) and 38.0% [19] from Haromaya. This might be due to differences in management systems, de-worming practice and/or agro-ecological conditions of the study area.

The prevalence of *H. gallinarum* in this study was by far higher than other studies in Ethiopia [20] (4.3%) and Kaingu *et al*. [21] (1.43%) in Kenya. The higher prevalence in the present study might be due to the fact that the chickens which included in this study were more of managed in extensive management system hence higher chance for infection with gastro-intestinal nematodes and from environmental conditions and traditional breeding which were suit-able for infections. Because, the chickens seek their food in the soil and this one is frequently contaminated with infective stages of parasites and living organisms (earthworms, insects and mollusks) which serve as intermediate hosts [22]. However, till the prevalence of the present study is lower than Berhanu *et al*., [23] reported *Heterakis gallinarum* (51.6%) in Ethiopia. The low prevalence of *Heterakis gallinarum* might be due to agro-ecological variation.

A relatively higher prevalence of *A. galli* over *H. gallinarum* has also been observed which is similar with previous several studies. Prevalence of 35.58% and

17.28% in Central Ethiopia [20]; 25.7% and 8.25% elsewhere from Pakistan [24]; 25.63% and 1.43%, in indigenous chicken from Kenya [21]; 48.39% and 35.48% from Nigeria [16] had been reported for *A. galli* and *H. gallinarum* respectively. Besides this much lower prevalence of *H. gallinarum* (1.43%) has been reported in indigenous chicken from Kenya [16]. But, Molla *et al*. [25] in North Gondar Administrative Zone reported that the most prevalent nematode species encountered was *Hetrakis gallinarium* (39.62%). This difference may be due to climatic variation.

In the present study, the prevalence of infection in local breed (51.55%) was significantly higher ($P<0.05$) than the exotic breed (33.6%). This result agreed with the previous studies conducted in Nigeria by Matur *et al*. [9] in local breed chickens (90.2%) higher than the exotic breed (53.0%). This is not uncommon because of their free range mode of management practice which allows them free access to virtually all types of environment and hence, predisposing them to various forms of infections [26]. In addition, domestic chickens feed widely which makes them more predisposed to infection. The duration for the local breed to reach table size is much longer compared to the exotic breeds which fed usually on artificial diets [27].

In the present study, sex seems to have high prevalence of GI nematodes, which could be related to the higher susceptibility of female animals. However, there was no significance difference ($\chi^2=0.896$ and $P>0.05$) in the prevalence of gastrointestinal nematode parasites in different sexes. It was in agreement with the work of Sonaiya [28] and Matur, *et al*. [9] that they reported female chickens were more infected with GI nematode parasites than the males in both local and exotic breeds. Because, female chickens are known to be more voracious in their feeding habits especially during egg production than the males which remain largely selective [28]. But this study was contrary with another report from Haromaya by Tesfahewet *et al.* [19] in which GI nematode infection was more prevalent in males (52.1%) than females (39.9%). This difference may be due to sample size and nutritional deficiency. The other report [29] indicated that there was no a usual natural affinity of GI nematode species to either sex of the host of chickens.

Higher prevalence of GI nematode infection rate was observed in adult chickens (50.6%) compared to grower chickens (38.9%) with a statistically significant difference ($p<0.05$). The result obtained was contrary with the previous study of Permin *et al*. [30] who reported higher level of GI nematode prevalence in grower chickens. This could be due to that grower chickens have lower level of immunity compared to adults. Similarly, Mungube *et al*. [31] also observed a higher prevalence of GI nematodes in grower chickens than in adults in Kenya.

CONCLUSION

This study has demonstrated high prevalence of gastrointestinal nematode parasites of chickens in both extensive and semi-intensive management systems in the study area within the survey period. Free-ranging birds have an increased opportunity to encounter the infective eggs, larvae and intermediate hosts of parasites that can cause serious debilitating infections.

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